

REGIONAL COMPETITION - ROUND 3

TOSS-UP

1. MATH; Multiple Choice: The equation $y = x^2 + 4$ has:
- a) 2 roots that are real numbers
 - b) 1 real root and 1 complex root
 - c) only complex numbers as roots
 - d) no roots

ANSWER: C--ONLY COMPLEX NUMBERS AS ROOTS

BONUS

1. MATH; short answer; a projectile, initially at (0,2) follows a trajectory given by $y = 2 + 12x - 2x^2$. What is the x coordinate when y is at its maximum value?

ANSWER: X=3

TOSS-UP

2. PHYS; Short Answer: The shear wave, often called a transverse wave, has particle motion at which angle with respect to the direction of travel.

ANSWER: PERPENDICULAR (ACCEPT 90 DEGREES -- OR TRANSVERSE)

BONUS

2. PHYS; Short Answer: A particle moves in a circle with constant angular speed. Its motion is projected onto a cartesian coordinate system located at the center of the circle. What type of motion does the projected image undergo?

ANSWER: SIMPLE HARMONIC

TOSS-UP

3. BIOL; Multiple Choice: Bacteria which derive their energy from the sun and their reducing power from inorganic chemicals are said to be:
- a) aphotolithotrophic
 - b) chemoheterotrophic
 - c) photoheterotrophic
 - d) chemolithotrophic

ANSWER: A-- PHOTOLITHOTROPHIC

BONUS

3. BIOL; Multiple Choice: The most reliable detective procedure now available to forensic scientists is:
- a) the lie detector
 - b) retinal scanning
 - c) DNA fingerprinting
 - d) hair analysis

ANSWER: C--DNA FINGERPRINTING

TOSS-UP

4. CHEM; Short Answer: What is the common name for potassium sodium tartrate?

ANSWER: ROCHELLE SALT

BONUS

4. CHEM; Short Answer: Who discovered nitroglycerin?

ANSWER:(ASCANIO) SOBRERO

TOSS-UP

5. COMP; Multiple Choice: The language most often used to obtain data from a database is:
- a) Jovial
 - b) SQL (pronounced S-Q-L)
 - c) COBOL
 - d) PL1 (pronounced P-L-1)

ANSWER: B-- SQL

BONUS

5. COMP; Short Answer: Researchers are exploiting a Josephson junction which remains superconducting and serves as a gate to admit units of magnetism, generated by external currents, into a tiny, superconducting ring known as a SQUID. What does SQUID stand for?

ANSWER: SUPERCONDUCTING QUANTUM INTERFERENCE DEVICE

TOSS-UP

6. BIOL; Multiple Choice: Substances that increase the rates of chemical reactions in biological systems are:
- a) lipids
 - b) enzymes
 - c) polysaccharides
 - d) nucleic acids

ANSWER: B--ENZYMES

BONUS

6. BIOL; Multiple Choice: Roughly translated, the scientific name Homo sapiens means:
- a) "walks on two legs"
 - b) "thinking man"
 - c) "uses hands for work"
 - d) "has a large brain"

ANSWER: B--"THINKING MAN"

TOSS-UP

7. PHYS; What is the amount of energy needed to raise one kilogram of water one degree centigrade?

ANSWER: A KILOCALORIE (ACCEPT 4.18 OR 4.2 KILOJOULES)

BONUS

7. PHYS; Short Answer: What quantum mechanical process is responsible for alpha decay?

ANSWER: THE TUNNEL EFFECT (ACCEPT QUANTUM TUNNELING)

TOSS-UP

8. CHEM; Short Answer: "Thermal NO_x" is defined as a mixture of nitrogen oxide and nitrogen dioxide formed from atmospheric nitrogen during the combustion of fuels. What is the name for the free-radical chain reaction mechanism by which atmospheric nitrogen is converted to nitrogen oxide?

ANSWER: THE ZELDOVICH MECHANISM

BONUS

8. CHEM; Short Answer: What is the first reaction in the Zeldovich mechanism?

ANSWER: THE FIRST STEP IN THE REACTION TO PRODUCE NITROGEN OXIDE IS THE DISSOCIATION OF OXYGEN TO PRODUCE OXYGEN FREE-RADICALS

TOSS-UP

9. ASTR; Multiple Choice: According to current theory, elements heavier than iron were formed:
- a) In supernovas
 - b) In White Dwarf stars
 - c) Through fission in stellar cores
 - d) In intergalactic space

ANSWER: A--IN SUPERNOVAS

BONUS

9. ASTR; Short Answer: What name was given to the planet that was once thought to be closer to the sun than Mercury?

ANSWER: VULCAN

TOSS-UP

10. PHYS; Multiple Choice: The main component of cosmic rays is:
- a) Alpha particles
 - b) Beta particles
 - c) High energy protons
 - d) Deuterons

ANSWER: C--HIGH ENERGY PROTONS

BONUS

10. PHYS; Multiple Choice: Quarks are building blocks of:
- a) Electrons
 - b) Bosons
 - c) Neutrons
 - d) Photons

ANSWER: C-- NEUTRONS

TOSS-UP

11. CHEM; Short Answer: Photochemical smog is the name given to the yellow-brown irritating haze that results from the action of sunlight on certain atmospheric pollutants present in the air over large cities. What two chemical substances from motor vehicles are required to be present initially for the formation of photochemical smog?

ANSWER: (VOLATILE) HYDROCARBONS AND NITROGEN OXIDES

BONUS

11. CHEM; Short Answer: What is the name of a well known organic strong oxidizing and irritating component of photochemical smog itself?

ANSWER: PEROXYACETYL NITRATE (PAN)

TOSS-UP

12. BIOL; Multiple Choice: Dioxins are a group of related chemicals that have recently been implicated in immune suppression, causing liver tumors and cleft palate. Because cleft palate is an anatomical disorder that occurs during fetal development, dioxins can then be classified as a:
- a) toxin
 - b) teratogen
 - c) carcinogen
 - d) mutagen

ANSWER: B--TERATOGEN

BONUS

12. BIOL; Short Answer: Dioxins are found in the products of chemical reactions, including a step in the production of WHITE paper. What process in the production of white paper is responsible for producing dioxin as a byproduct?

ANSWER: BLEACHING or CHLORINATION or CHLORINE

TOSS-UP

13. ERSC; Short Answer: Most of the world's water is found in the oceans. Where is the second largest reservoir?

ANSWER: GLACIERS (ACCEPT POLAR ICE CAPS OR ANTARCTICA)

BONUS

13. ERSC; Multiple Choice: The earth's surface is approximately two thirds covered by water. What percentage of this water is fresh water?
- a) 1-3%
 - b) 5-10%
 - c) 10-20%
 - d) 20-30%

ANSWER: A--1-3%

TOSS-UP

14. CHEM; Multiple Choice: The geometry associated with a sp^3d^2 hybridization is
- a) octahedral
 - b) tetrahedral
 - c) trigonal bipyramidal
 - d) trigonal planar

ANSWER: A--OCTAHEDRAL

BONUS

14. CHEM; Multiple Choice: The geometry associated with a sp^3d hybridization is
- a) tetrahedral
 - b) trigonal bipyramidal
 - c) trigonal planar
 - d) square planar

ANSWER: B--TRIGONAL BIPYRAMIDAL

TOSS-UP

15. PHYS; Multiple Choice: The fundamental equations which relate electric and magnetic fields to each other and to the charges and currents which produce them are:
- a) Fourier transforms
 - b) Maxwell's equations
 - c) Gauss' theorem
 - d) Einstein's equations

ANSWER: B--MAXWELL'S EQUATIONS

BONUS

15. PHYS; Multiple Choice: Which radiation detection probe will detect alpha radiation only?
- a) Geiger Mueller probe
 - b) Rem ball
 - c) Zinc sulfide scintillation probe
 - d) Ion chamber

ANSWER: C--ZINC SULFIDE SCINTILLATION PROBE

TOSS-UP

16. BIOL; Short Answer: The group of plant hormones or growth regulators are known as?

ANSWER: AUXINS

BONUS

16. BIOL; Multiple Choice: At very high altitudes, the oxygen pressure is too low to force sufficient oxygen into the blood. People who live permanently at such altitudes adapt by which of the following means?
- a) breathing faster
 - b) moving slower
 - c) producing more red blood cells
 - d) increasing their blood pressure

ANSWER: C--PRODUCING MORE RED BLOOD CELLS

TOSS-UP

17. CHEM; Multiple Choice: What is the normality of an acid if 12.0 ml are required to titrate 15.0 ml of 0.8 N NaOH?
- a) 1.30 N acid
 - b) 1.00 N acid
 - c) 3.00 N acid
 - d) 0.65 N acid

ANSWER: B--1.00 N ACID

BONUS

17. CHEM; Multiple Choice: A class of organic molecules possessing a combination of aliphatic and cyclic structures with a coiled or helical formation is:
- a) terpene hydrocarbons
 - b) amino acids
 - c) proteins and nucleic acids
 - d) aromatics

ANSWER: C--PROTEINS AND NUCLEIC ACIDS

TOSS-UP

18. MATH; Multiple Choice: The function "y equals the absolute value of x" is:
- a) differentiable everywhere
 - b) only defined for integers
 - c) not differentiable anywhere
 - d) not differentiable at x equals zero

ANSWER: D--NOT DIFFERENTIABLE AT X EQUALS ZERO

BONUS

18. MATH; Short Answer: What geometric region is described by the inequality "x plus y is less than 2"?

ANSWER: HALF-PLANE

TOSS-UP

19. ASTR; Short Answer: In 1572, the Danish Astronomer Tycho Brahe observed a supernova in what constellation?

ANSWER: CASSIOPEIA

BONUS

19. ASTR; Multiple Choice: In November 1993 Mercury passed across the face of the sun, as viewed from earth. About how often does this happen each century?

- a) 100
- b) 25
- c) 10
- d) 1

ANSWER: C--10

TOSS-UP

20. BIOL; Multiple Choice: Seeds resulting from crossing white and red flowers develop into hybrids with pink flowers. What proportion of white, red and pink flowers are represented in the offspring of two pink plants?

- a) 1/3 white 1/3 red 1/3 pink
- b) 1/3 " 1/6 " 1/6 "
- c) 1/4 " 1/4 " 1/2 "
- d) 1/2 " 1/3 " 1/6 "

ANSWER: C--1/4 WHITE 1/4 RED 1/2 PINK

BONUS

20. BIOL; Multiple Choice: Who published a book on the theory of evolution which based evolutionary change on the inheritance of acquired characteristics?

- a) Lamarck
- b) Darwin
- c) Cuvier
- d) Lyell

ANSWER: A--LAMARCK

TOSS-UP

21. GENR; Short Answer: The process of converting AC to DC is known as?

ANSWER: RECTIFICATION

BONUS

21. GENR; Short Answer: Connecting positive voltage to the N-type terminal of a standard diode is known as?

ANSWER: REVERSE BIASING

TOSS-UP

22. ERSC; Multiple Choice: Seawater has been shown to be enriched in the stable isotope of hydrogen called deuterium. This is because water molecules containing the lighter hydrogens are easier to evaporate than the water molecules containing the heavier deuterium atoms. The preferential enrichment of one isotope over another is called?

- a) Fractionation
- b) Ion exchange
- c) Hydrolysis
- d) Condensation

ANSWER: A--FRACTIONATION

BONUS

22. ERSC; Multiple Choice: The discontinuity layer which separates the earth's crust from the mantle is called the Moho. How was this discontinuity layer discovered?

- a) refracted P waves
- b) analyzing the zeta potential
- c) Tsunami waves (pron. sue-nami)
- d) Cnoidal waves (pron. noy-dal)

ANSWER: A--REFRACTED P WAVES

TOSS-UP

23. PHYS; Multiple Choice: In equal thickness, which of the following would be most effective shield against BETA radiation?
- a) Air
 - b) Tissue paper
 - c) Aluminum
 - d) Plastic wrap

ANSWER: C--ALUMINUM

BONUS

23. PHYS; Multiple Choice: In equal thickness, which of the following would be the most effective shield against NEUTRON radiation?
- a) Paper
 - b) Aluminum
 - c) Concrete
 - d) Air

ANSWER: C--CONCRETE

TOSS-UP

24. COMP; Multiple Choice: Which of the following languages is most object-oriented?
- a) FORTRAN 70
 - b) COBOL
 - c) Pascal
 - d) C + +

ANSWER: D--C + +

BONUS

24. COMP; Multiple Choice: Which of the following languages are stack based? That is, operands are pushed onto a stack and popped when needed.
- a) Postscript
 - b) Pascal
 - c) FORTH
 - d) Postscript and FORTH

ANSWER: D-- POSTSCRIPT AND FORTH

TOSS-UP

25. GENR; Short Answer: The information signal used to modulate a carrier is also known as what?

ANSWER: THE BASEBAND SIGNAL

BONUS

25. GENR; Short Answer: What does the term "equinox" mean?

ANSWER: EQUAL NIGHT
